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A New Species and a New Record of the Genus *Baculentulus* (Protura, Acerentomidae) from Japan

Osami NAKAMURA

Saitama Museum of Natural History, Nagatoro 1417,
Chichibu-gun, Saitama Pref., 369–13 Japan

Abstract *Baculentulus sakayorii* sp. nov. is described and *B. loxoglenus* YIN newly recorded from Japan.

Key words: Protura; *Baculentulus*; new species; new record.

Two interesting baculentomid forms have been obtained from several localities in central and eastern parts of Honshu. Close examination revealed that one is new to science and the other new to Japan.

Baculentulus loxoglenus YIN

(Figs. 1–20)

Baculentulus loxoglenus YIN, 1980, 148–151, 155–156.

Baculentulus sp. 1: NAKAMURA, 1985, 4.

Specimens examined: 4 ♀, Takasasu, 35°59'N, 138°57'E, deciduous broad-leaved forest dominated by *Castanea crenata* and *Quercus serrata*, 780 m alt., Ryokami-mura, Saitama Pref., 19-X-1982, O. NAKAMURA leg.; 4 ♂ 4 ♀, Azumaya-san, 36°00'N, 138°57'E, deciduous broad-leaved forest dominated by *Q. serrata*, 770 m alt., Ryokami-mura, Saitama Pref., 4-XII-1982, O. NAKAMURA leg.; 1 ♀, 1 LII, the Okuchichibu forestry road, 35°57'N, 138°45'E, mixed forest dominated by *Tsuga diversifolia* and *Betula ermani*, 1740 m alt., Ootaki-mura, Saitama Pref., 9-XII-1985, O. NAKAMURA leg.; 2 ♂, Hacchozaka, 35°56'N, 138°44'E, evergreen coniferous forest dominated by *T. diversifolia*, 1850 m alt., Kawakami-mura, Nagano Pref., 11-III-1987, O. NAKAMURA leg.

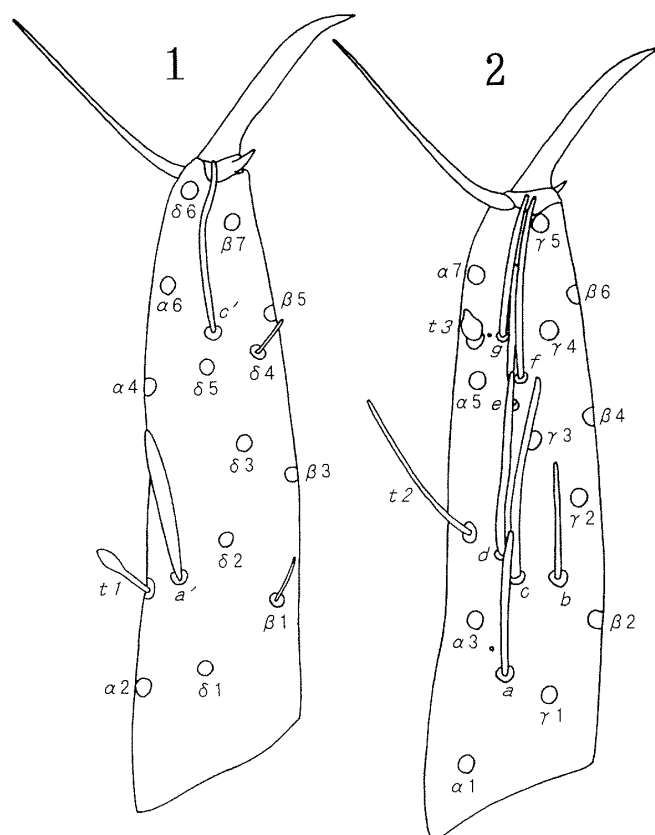
A part of specimens of here examined are to be deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo, and the remainings are in my collection.

Description on the specimens from central Japan.

Body length 670–800 µm in expanded specimens (870 µm in maximum).

Head oval, 86–95 µm in dorsal view, with additional setae (a in Fig. 3).

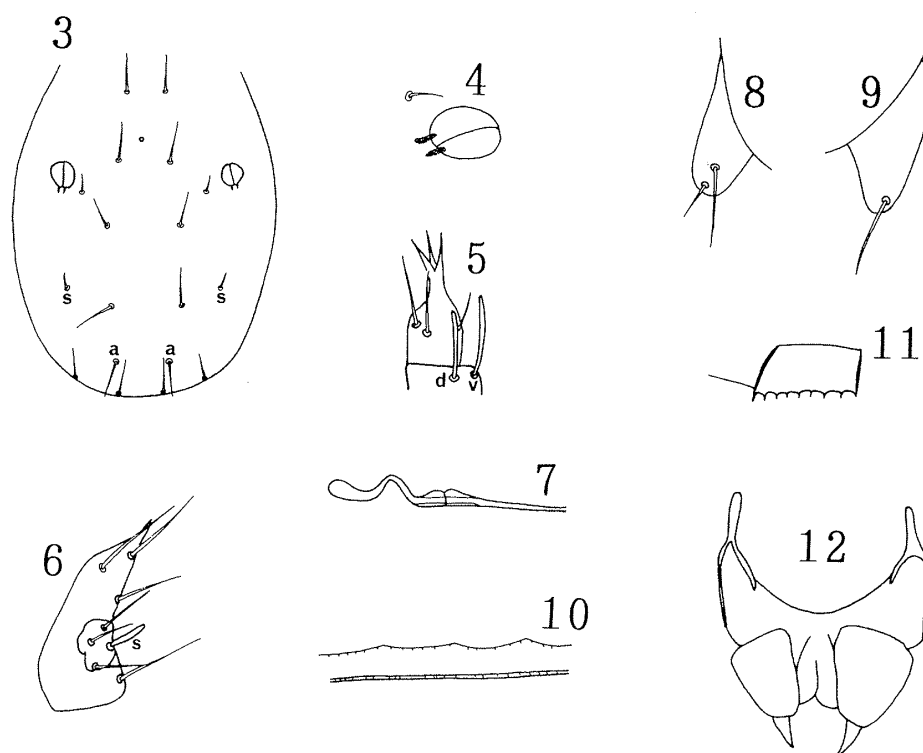
A median pore present. S-seta (s in Fig. 3) sensilla-like, similar to accessory



Figs. 1-2. *Baculentulus loxoglenus* YIN from Japan. — 1, Interior view of foretarsus; 2, exterior view of foretarsus.

setae on abdomen I-VII. Maxillary palpus with two sensillae on penultimate segment, dorsal and ventral sensillae similar to each other in shape, but the former slightly shorter than the latter (Fig. 5). Labial palpus rudimentary, with three setae and one sensilla (Fig. 6). Pseudoculus almost circular, with two small lids (Fig. 4), 6-7 μm , PR=13-15. Canal of maxillary gland simple (Fig. 7).

Foretarsus (Figs. 1 & 2) 55-67 μm , claw 17-21 μm , TR=3.1-3.5; empodium short, EU=0.11-0.16; S-shaped seta longer than claw. Dorsal sensilla *t1* baculiform, BS=0.45-0.54; *t2* thin; *t3* small. Exterior sensilla *a* surpassing the base of *d*; *b* relatively short, not surpassing the base of $\gamma 3$; *c* and *d* reaching the base of *f*; *f* a little nearer to *e* than to *g*, *f* and *g* surpassing tarsus. Interior sensilla *a'* a little broad, situated at nearly the same level as *t1*; *b'* absent; *c'* surpassing tarsus. Ventral seta $\beta 1$ and interior seta $\delta 4$ both sensilla-like, short, being 5-6 μm . Interior setae $\delta 1$, $\delta 2$, $\delta 3$ and $\delta 5$ short, being 8-9 μm , but longer than $\delta 4$ and apically pointed. Pores present between *a* and $\alpha 3$, and between *t3* and *g*, respectively. Middle tarsus 25-30 μm , its claw 15-17 μm ; hind tarsus 28-34 μm , its claw 15-18 μm .



Figs. 3–12. *Baculentulus loxoglenus* YIN from Japan. — 3, Head; 4, pseudoculus; 5, maxillary pulpus; 6, labial pulpus; 7, canal of maxillary gland; 8, abdominal appendage III; 9, ditto, in an aberrant example from the Okuchichibu forestry road; 10, striate band on abdomen VIII; 11, comb on abdomen VIII; 12, female squama genitalis. Signs: a, additional seta; d, dorsal sensilla; s, sensilla-like seta; ss, sensilla; v, ventral sensilla.

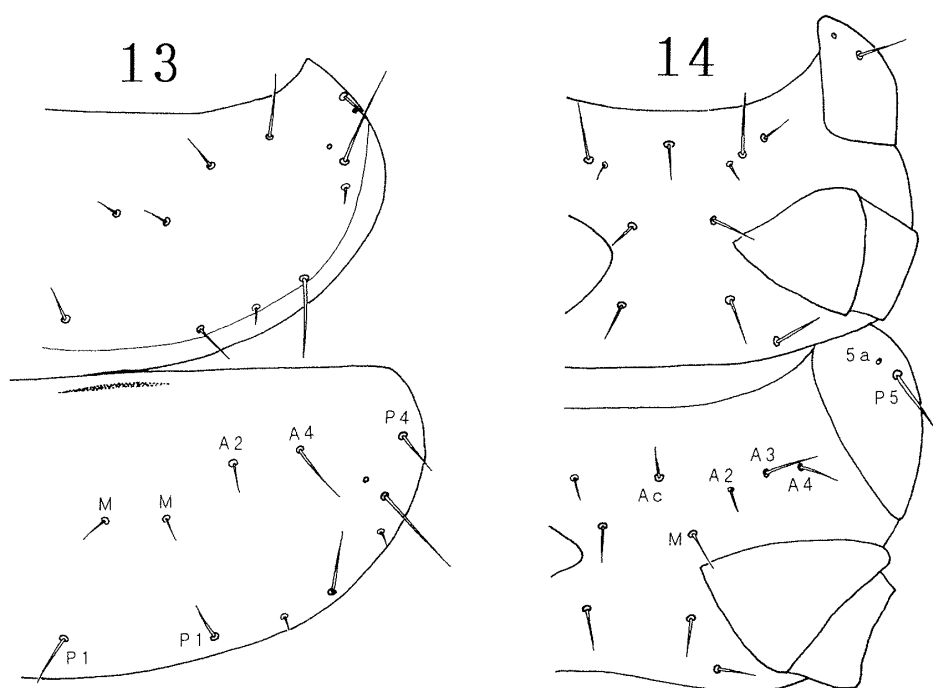
Chaetotaxy as in Table 1 and Figs. 13–20. Abdominal tergites I–VI each with three pairs of anterior setae, A1, 2 and 5; terg. VII with A2, 4 and 5. On tergs. II–VII, P3 situated a little anteriorly to the other principal setae. Sternite VIII without posterior seta. Dorsal P1a and 2a on thoraces II·III shortly and thinly lanceolate, less than $3\ \mu\text{m}$ in length; P5a on thoraces II·III rudimentary (Fig. 14). Ventral A2 and M2 on th. I, ventral A2 on ths. II·III, P1a, 2a and A5 on abdominal tergite I, P1a, 2a and 4a on tergs. II–VII, P2 on abd. sternites II·III, P1a on sterns. IV–VII short and sensilla-like, less than $5\ \mu\text{m}$ in length. P1 and 2 on thoracic tergite III $9\text{--}11\ \mu\text{m}$ and $12\text{--}16\ \mu\text{m}$ respectively; P1 and 2 on terg. VI $13\text{--}16\ \mu\text{m}$ and $16\text{--}20\ \mu\text{m}$; 4 and 5 on terg. IX $15\text{--}19\ \mu\text{m}$; 4 and 5 on terg. X $16\text{--}21\ \mu\text{m}$ and $15\text{--}20\ \mu\text{m}$; P1 and 2 on stern. VII $13\text{--}18\ \mu\text{m}$ and $20\text{--}18\ \mu\text{m}$; 1 and 2 on stern. IX $8\text{--}10\ \mu\text{m}$ and $20\text{--}22\ \mu\text{m}$; 1 and 2 on stern. X $8\text{--}10\ \mu\text{m}$ and $20\text{--}24\ \mu\text{m}$.

Integumental pore distinct. Thoracic tergite II with two pairs of pores, one being anterior to P3 and the other posterior to P4; III with a pair of pores anterior to P3 (Fig. 13). Abdominal tergites I–VI each with a pair of pores

Table 1. Chaetotaxy of *Baculentulus loxoglenus* YIN from Japan.

		Larva II		Imago	
		Formula	Composition of setae	Formula	Tertiary and complementary setae
(Dorsal)					
Thorax	I	4	1, 2	4	
	II-III	$\frac{6}{14}$	A2, 4, M P1, 1a, 2, 3, 4, 5, 5a	$\frac{6}{16}$	P2a
Abdomen	I	$\frac{0}{10}$	P1, 2, 2a, 3, 5	$\frac{6}{12}$	A1, 2, 5 P1a
	II-VI	$\frac{0}{12}$	P1, 2, 2a, 3, 4, 5	$\frac{6}{16}$	A1, 2, 5 P1a, 4a
	VII	$\frac{0}{14}$	P1, 2, 2a, 3, 4, 4a, 5	$\frac{6}{16}$	A2, 3, 5 P1a
	VIII	$\frac{2-6}{8}$	A3, M2, 3, 4 P2, 3, 4, 5	$\frac{6-7}{8}$	A1, 5, Mc
	IX	8	1, 2, 4, 5	14	3, 3a, 4a
	X			12	1, 2, 3, 3a, 4, 5
	XI			6	1, 2, 3
	XII	9	c, 1, 2, 3, 4	9	
(Ventral)					
Thorax	I	$\frac{2-2}{4}$	A1, M1 P1, 2	$\frac{4-4}{6}$	A2, M2 P3
	II-III	$\frac{5-2}{2}$	Ac, 2, 3, M P1	$\frac{7-2}{4}$	A4 P2
Abdomen	I	$\frac{3}{2}$	Ac, 2 P1	$\frac{3}{2}$	
	II-III	$\frac{0}{3}$	Pc, 3	$\frac{3}{5}$	Ac, 2 P2
	IV-VII	$\frac{1}{6}$	Ac P1, 2, 3,	$\frac{3}{8}$	A2 P1a
	VIII	$\frac{4}{0}$	1, 2	$\frac{4}{0}$	
	IX	4	1, 2	4	
	X			4	1, 2
	XI			6	1, 2, 3
	XII	6	1, 2, 3	6	

posterior to A2 (Figs. 15-18); VII with two pairs of pores, one being anterolateral to P1a and the other between P3 and P4 (Fig. 19). Tergs. II-VI each with a pair of anterolateral pore (sensu SZEPTYCKI, 1988) (Fig. 16-18). Small rotary wheels present on tergs. V-VII (R in Figs. 18 & 20). Sternites V-VI

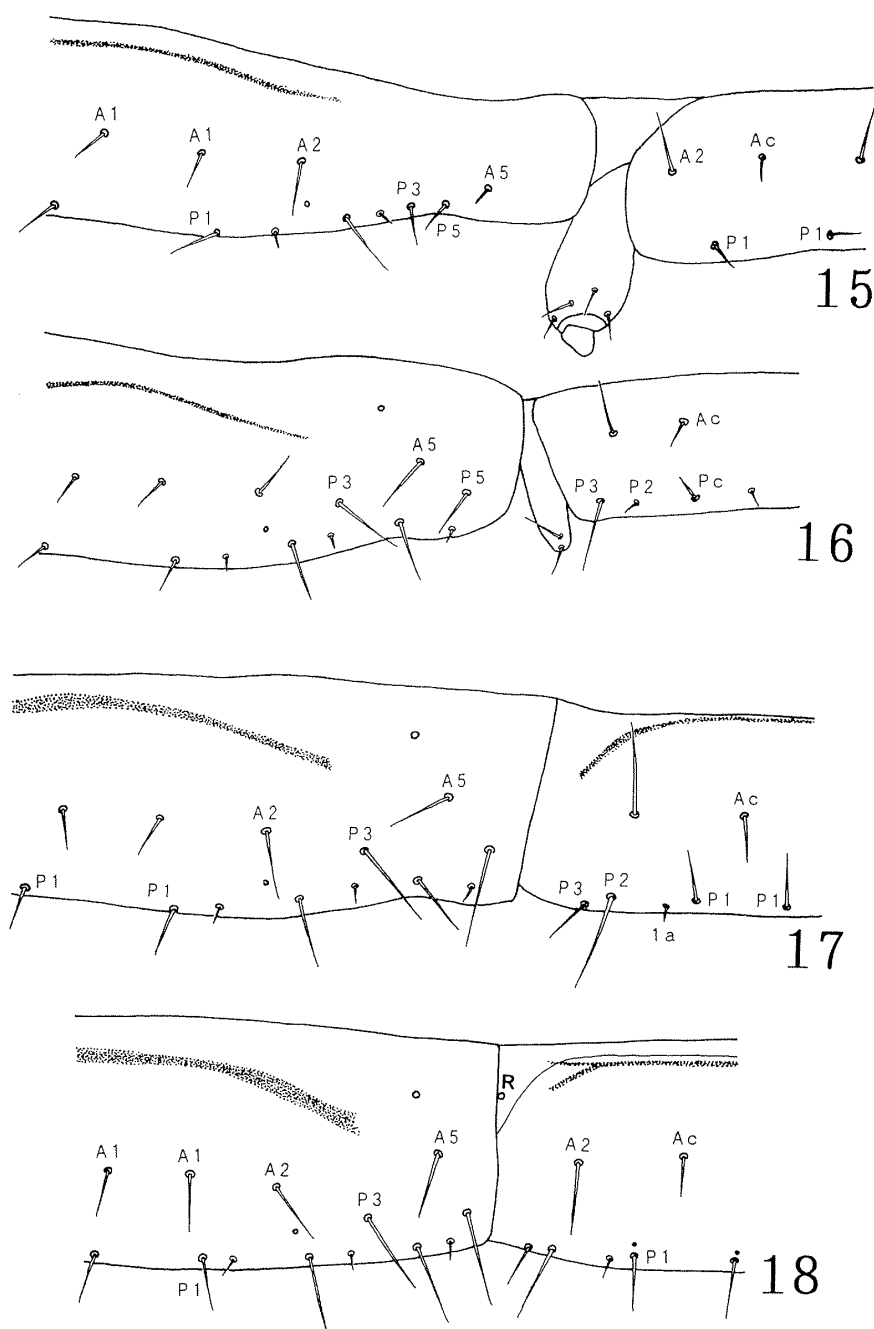


Figs. 13–14. *Baculentulus loxoglenus* YIN from Japan. — 13, Dorsal view of thoraces II·III; 14, ventral view of thoraces II·III.

with a pair of pores close anterior to P1 (Fig. 18); VII with a pore anterior to one of P1 (Fig. 20). Telson with a dorsal central pore and a pair of ventral pores at anterior edge (Figs. 19 & 20).

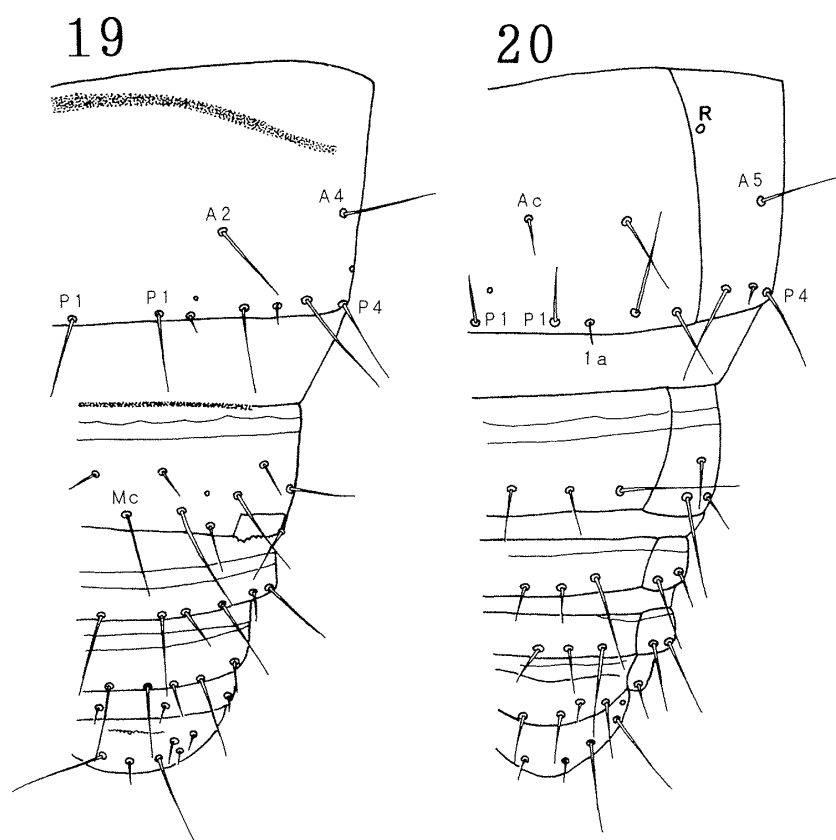
Abdominal appendages II·III each with two setae; the median apical seta subequal to a half of subapical one in length (Fig. 8). On abd. VIII, striate band reduced (Fig. 10); comb almost rectangular and consisting of about 9 small teeth (Fig. 11). Terg. XII with pectinate line (Fig. 19). Female squama genitalis with pointed acrostylus (Fig. 12).

Larva II. Body length 663 μm in expanded condition, head 73 μm , pseud-oculus 5.9 μm , PR=12.3. Foretarsus 46 μm , claw 15 μm , TR=3.0, EU=0.19, BS=0.48. The shape and position of foretarsal sensillae and pores similar to those of adults. P5a on thoracic tergite II minute, P5a on III rudimentary. Middle tarsus 21 μm , its claw 13 μm ; hind tarsus 24 μm , its claw 13 μm . Integumental pores distinct. Thoracic tergite III with a pair of pores anterior to one of P3; terg. V·VI with a pair of pores anterior to P2; VI with anterolateral pore; VII with a pair of pores between P1 and 2; VIII with a pair of pores between M2 and 3; stern. VI with a pair of pores anterior to P1; VII with a pore anterior to one of P1; telson with a dorsal central pore and a pair of ventral pores at anterior edge. On head pore invisible.



Figs. 15–18. *Baculentulus loxoglenus* YIN from Japan. — 15, Abdomen I; 16, abdomen II; 17, abdomen IV; 18, abdomen VI. Sign: R, rotary wheel.

Notes. Through the courtesy of Professor YIN, I had a chance to examine the type specimens (1♂1♀ from Yichun, Heilunjiang Province, 2–VI–1979). The close examination revealed that the above two type specimens both possess 6 setae on sternite XI as well as in Japanese specimens (4 setae in the original description). On the other hand, slight differences were found between Chi-



Figs. 19–20. *Baculentulus loxoglenus* YIN from Japan. — 19, Dorsal view of abdomen VIII–XII; 20, ventral view of abdomen VIII–XII. Sign: R, rotary wheel.

nese and Japanese specimens in the shape of pseudoculus, the ratio TR, the relative length of foretarsal sensilla c' , and the absence of P2 on abdominal sternite I in Japanese ones. It is likely, however, that these differences are regarded as conspecific variation.

Chaetotaxic abnormalities were often observed. Of fifteen adults, abnormalities were found in three males and seven females as follows: presence of P2a' on th. terg. III (one male) and absence of P1 on th. terg. II (one female), M2 on th. stern. I (one female), A4 on th. stern. III (one female), P1a on abd. terg. I (one female), 2a on abd. terg. I (one female), P4a on abd. terg. III (one male), P1a on abd. terg. VII (one female), A1 on abd. terg. VIII (one female), 4a on terg. IX (three females), 5 on terg. IX (one female), Ac on abd. stern. III (one male), P2 on stern. III (one male), 1 on stern. IX (one female), and 3 on stern. XII (one female). Asymmetric absence of A2 on abd. stern. I and apical setae on abd. appendage III (Fig. 9) were also observed in one Larva II and one female, respectively, from the Okuchichibu forestry road.

Distribution. China and new to Japan (Honshu).

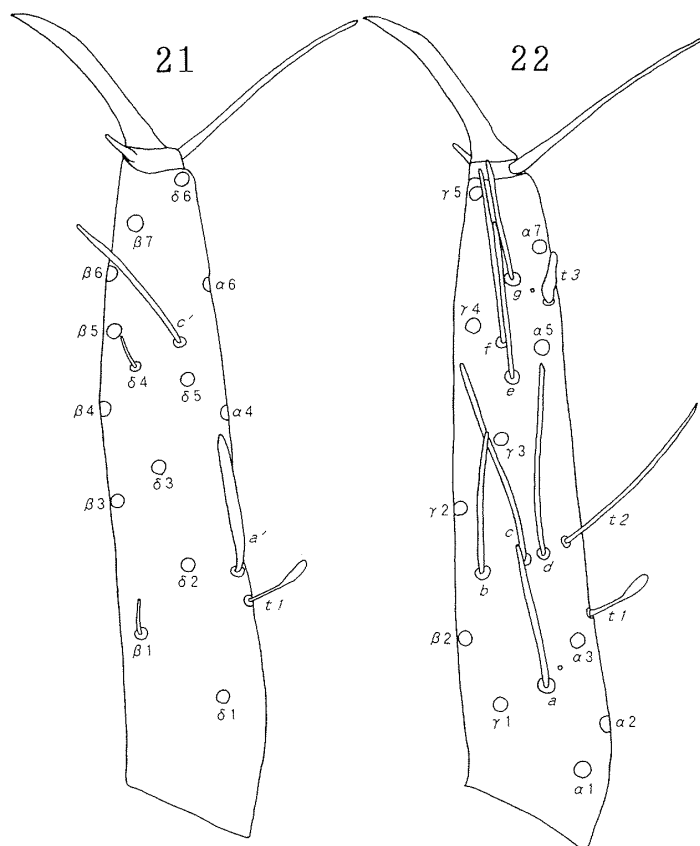
Baculentulus sakayorii sp. nov.

(Figs. 21–37)

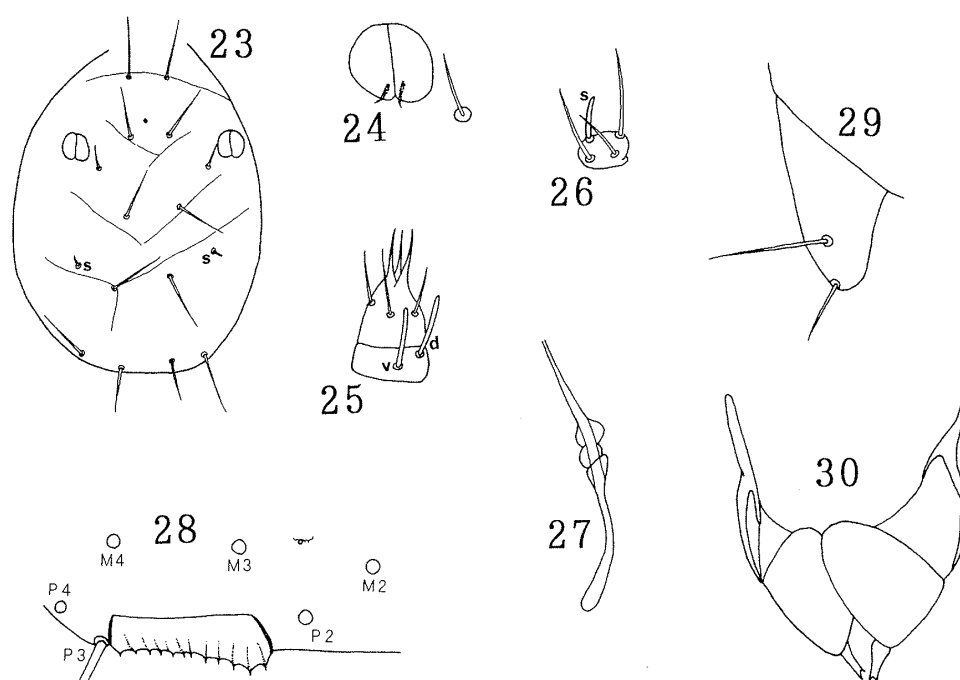
Body length 710–850 μm in not fully expanded specimens (995 μm in full expansion).

Head oval, 97–106 μm in dorsal view, without additional setae (Fig. 23). A median pore present; S-setae (s in Fig. 23) sensilla-like, similar to accessory setae on abdomen I–VII. Maxillary palpus with two sensillae on penultimate segment, dorsal and ventral sensillae similar to each other in shape and length (Fig. 25). Labial palpus rudimentary, with three setae and one slender sensilla (Fig. 26). Pseudoculus almost circular (Fig. 24), 7.2–8.6 μm x 7.9–8.6 μm , PR=12.1–13.4. Canal of maxillary gland simple (Fig. 27).

Foretarsus (Figs. 21 & 22) 83–90 μm , claw 22–26 μm , TR=3.4–3.9; empodium short, EU=0.11–0.18; S-shaped seta longer than claw. Dorsal sensilla *t1* baculiform, BS=0.52–0.59; *t2* thin; *t3* relatively long. Exterior sensilla *a* reaching the base of *d*; *b* relatively short, reaching the base of $\gamma 3$; *c* and *d* surpassing *e*; *f* nearer to *e* than to *g*, its apex slightly surpassing tarsus; *g*



Figs. 21–22. *Baculentulus sakayorii* sp. nov. — 21, Interior view of foretarsus; 22, exterior view of foretarsus.



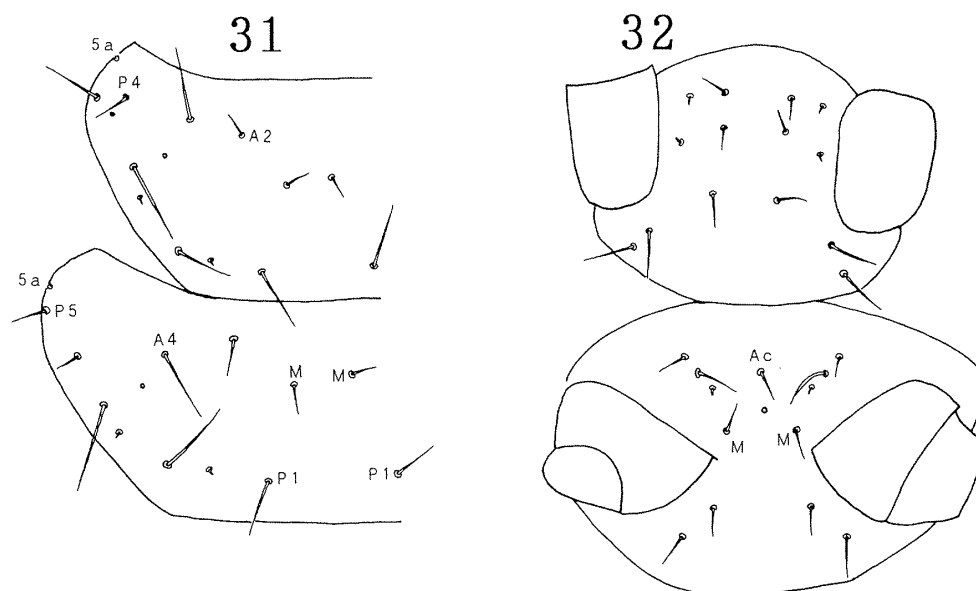
Figs. 23–30. *Baculentulus sakayorii* sp. nov. — 23, Head; 24, pseudoculus; 25, maxillary pulpus; 26, labial pulpus; 27, canal of maxillary gland; 28, comb on abdomen VIII; 29, abdominal appendage III; 30, female squama genitalis. Signs: d, dorsal sensilla; s, sensilla-like seta; ss, sensilla; v, ventral sensilla.

reaching the base of claw. Interior sensilla a' a little broad and a little distal to $t1$; b' absent; c' not surpassing tarsus. Ventral seta $\beta 1$ and interior seta $\delta 4$ both short and sensilla-like, 4–5 μm . Interior setae $\delta 1$, $\delta 2$, $\delta 3$ and $\delta 5$ each short, but longer than $\delta 4$, 10–13 μm , and apically pointed. Pores present between a and $a3$, and between $t3$ and g , respectively. Middle tarsus 36–38 μm , its claw 16–19 μm ; hind tarsus 43–46 μm , its claw 18–20 μm .

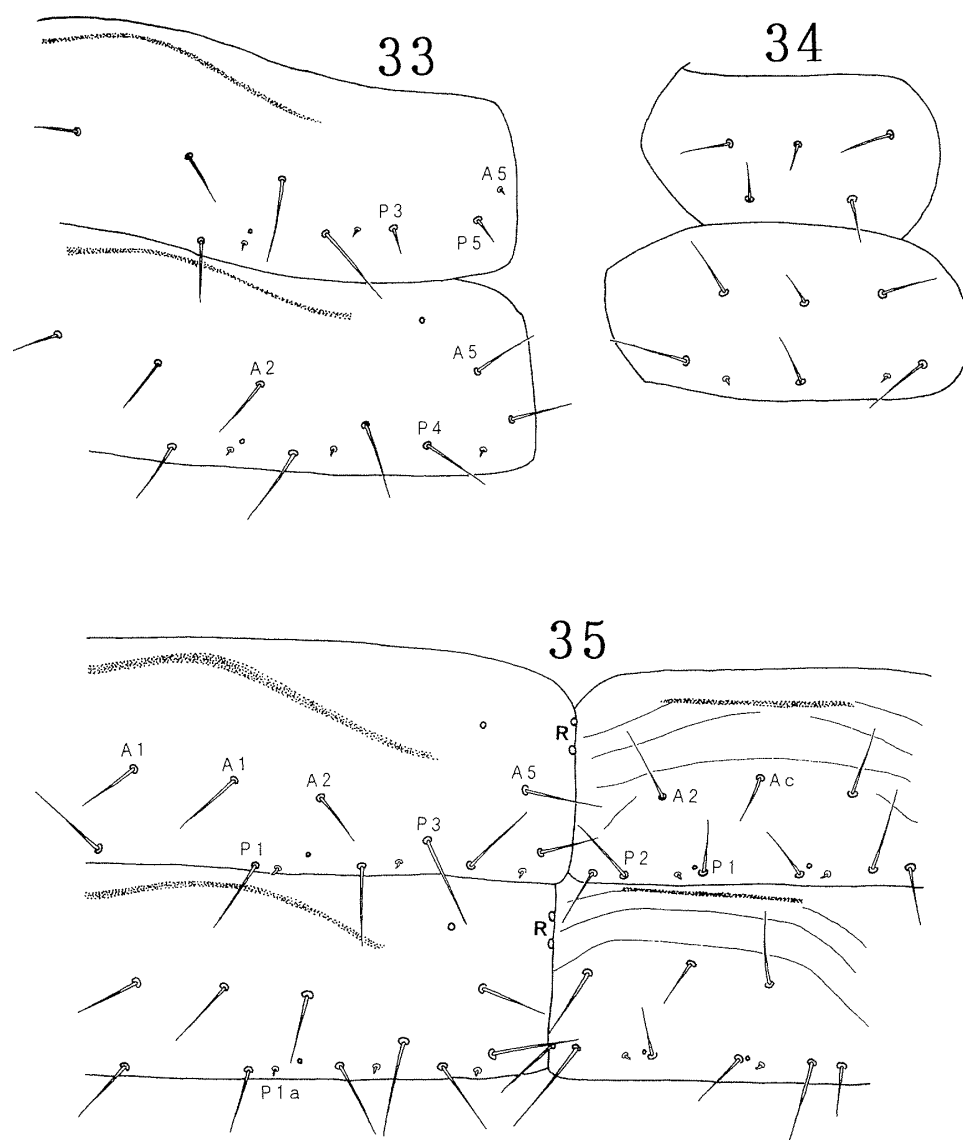
Chaetotaxy as in Table 2 and Figs. 31–37. Abdominal tergites I–VI each with three pairs of anterior setae, A1, 2 and 5; terg. VII with A2, 4 and 5. On tergs. II–VII, P3 situated a little anterior to the other principal setae. Sternite VIII without posterior seta. Ventral setae A2 and M2 on thoracic stern. I, dorsal P1a, 2a and ventral A2 on thoraces II·III, A5 on abdominal terg. I, P2 on abd. sterns. II·III and all the accessory setae on abdomen I–VII similar to each other in shape, short and blunt, about 3 μm . P5a on th. terg. II·III minute, about 2 μm and 1.5 μm , respectively. P1 and 2 on th. terg. III 17–20 μm and 24–30 μm , respectively; P1 and 2 on abd. terg. VI 21–24 μm and 22–30 μm ; 4 and 5 on terg. IX 18–22 μm and 19–24 μm ; 4 and 5 on terg. X 20–26 μm and 15–24 μm ; P1 and 2 on abd. terg. VI 14–17 μm and 30–34 μm ; 1 and 2 on stern. IX 8–11 μm and 25–29 μm ; and 1 and 2 on stern. X 7–10 μm and 24–29 μm .

Table 2. Chaetotaxy of *Baculentulus sakayorii* sp. nov.

		Dorsal		Ventral	
		Formula	Composition of setae	Formula	Composition of setae
Thorax	I	4	1, 2	$\frac{4-4}{6}$	A1, 2, M1, 2 P1, 2, 3
	II-III	$\frac{6}{16}$	A2, 4, M P1, 1a, 2, 2a, 3, 4, 5, 5a	$\frac{7-2}{4}$	Ac, 2, 3, 4, M P1, 2
Abdomen	I	$\frac{6}{12}$	A1, 2, 5 P1, 1a, 2, 2a, 3, 5	$\frac{3}{2}$	Ac, 2 P1
	II-III	$\frac{6}{16}$	A1, 2, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{5}$	Ac, 2 Pc, 2, 3
	IV-VI	$\frac{6}{16}$	A1, 2, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{8}$	Ac, 2 P1, 1a, 2, 3
	VII	$\frac{6}{16}$	A2, 4, 5 P1, 1a, 2, 2a, 3, 4, 4a, 5	$\frac{3}{8}$	Ac, 2 P1, 1a, 2, 3
	VIII	$\frac{6-8}{8}$	A1, 3, 5, M1, 2, 3, 4 P2, 3, 4, 5	$\frac{4}{0}$	1, 2
	IX	14	1, 2, 3, 3a, 4, 4a, 5	4	1, 2
	X	12	1, 2, 3, 3a, 4, 5	4	1, 2
	XI	4	2, 3,	6	1, 2, 3
	XII	9	c, 1, 2, 3, 4	6	1, 2, 3

Figs. 31-32. *Baculentulus sakayorii* sp. nov. — 31, Dorsal view of thoraces II-III; 32, ventral view of thoraces II-III.

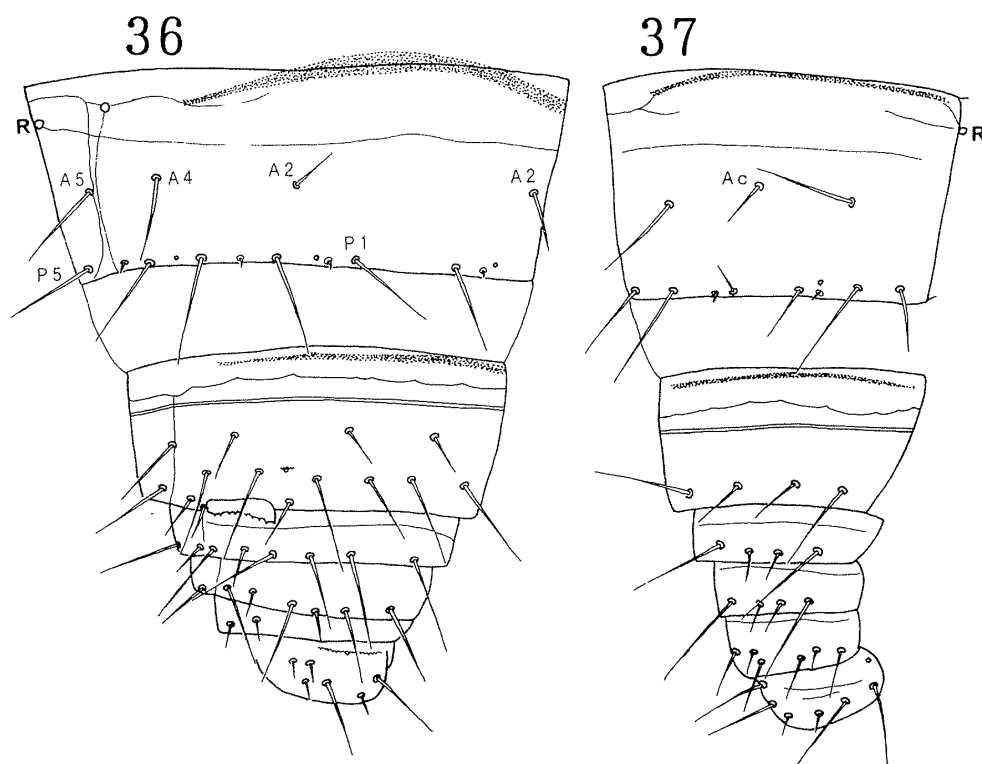
Integumental pore distinct. Thoracic tergite II with two pairs of pores, one being anterior to P3 and the other posterior to P4; III with a pair of pores anterior to P3 (Fig. 31); sternites II-III each with single pore posterior to Ac



Figs. 33–35. *Baculentulus sakayorii* sp. nov. — 32, Dorsal view of abdomen I–II; 33, ventral view of abdomen I–II; 35, abdomen V–VI. Sign: R, rotary wheel.

(Fig. 32). Abdominal tergites I–VI each with a pair of pores between P1a and P2 (Fig. 33 & 35); VII with two pairs of pores, one being anterolateral to P1a and the other between P3 and P4 (Fig. 36). Terg. II–VI each with a pair of anterolateral pores (sensu SZEPTYCKI, 1988)(Figs. 33, 35 & 36). Small rotary wheels present on terg. IV–VII; a pair of wheels on IV and VI, and two or three pairs on V and VI (R in Fig. 35). Sternites IV–VI each with a pair of pores anterolaterally to P1 (Fig. 35); VII with a pore anteriorly to one of P1a (Fig. 37). Telson with a dorsal central pore and a pair of ventral pores at anterior edge (Figs. 36 & 37).

Abdominal appendages II and III each with two setae; apical seta subequal



Figs. 36–37. *Baculentulus sakayorii* sp. nov. — 36, Dorsal view of abdomen VIII–XII; 37, ventral view of abdomen VIII–XII.

to a half of subapical one in length (Fig. 29). On abd. VIII, striate band reduced; comb oblique and with about 12 small teeth (Fig. 28). Terg. XII with pectinate line (Fig. 36). Female squama genitalis with bipartite acrostylus (Fig. 30).

Holotype: ♀, Nishikanasa Shrine, 36°39'N, 140°27'E, 420 m alt., Kami-miyakawauchi, Kanasagou-machi, Ibaraki Pref., 30-V-1993, H. SAKAYORI leg. **Paratypes:** 3♂2♀, same data as holotype; 2♂2♀, Kashima Shrine, 35°58'N, 140°38'E, evergreen broad-leaved forest dominated by *Castanopsis cuspidata* var. *sieboldii*, 40 m alt., Kashima-machi, Ibaraki Pref., 6-XII-1986, H. SAKAYORI leg.

The holotype and a part of paratypes are to be deposited in the collection of the National Science Museum (Nat. Hist.), Tokyo.

Further specimens examined. 9♂7♀, Kashima Shrine, same data as paratypes; 1♂2♀, Mt. Tsukuba, 36°13'N, 140°07'E, deciduous broad-leaved forest dominated by *Fagus crenata*, 800 m alt., Tsukuba-shi, Ibaraki Pref., 5-XI-1983, H. SAKAYORI leg.

Remarks. The present species is similar to *B. densus* (IMADATÉ, 1960) from Japan (cf. IMADATÉ, 1974) and *B. weinerae* SZEPTYCKI et IMADATÉ, 1987 from North Korea in possessing short sensilla *b* and lacking *b'* on

foretarsus. However, it is distinguished from these two by the presence of P1a on abd. terg. I–VI, further from *B. densus* by the shape of foretarsal sensilla *t3*, relative length of *d* and the ratio BS, and from *B. weinerae* by the position of foretarsal sensilla *a'* and the relative lengths of *b* and *f*.

Notes. Of 29 specimens examined, chaetotaxic abnormalities were found in six specimens as follows: absence of Ac on th. stern. II (one female), asymmetric absence of P1a on abd. tergs. I–III (one female), P4a on terg. V, Ac on abd. stern. II and V (one female) and P2 on stern. II (one male), asymmetric presence of A1 on terg. VII (one female), and presence of senseilla-like Pc on abd. stern. VII (one male).

Porotaxic abnormalities were also observed in eight specimens: a pore presence between P1 setae (one male), or anteriorly to one of P1 (one male and four females) on abd. stern. I, a pore between Pc and one of P2 on abd. stern. II–III (one female), a pore posteriorly to Ac (one female) or anterolaterally to one of P2 (one male and one female) on abd. stern. III, a small rotary wheel on abd. III (one female) and two pairs of small rotary wheels on terg. IV (one male and one female).

Distribution. Japan (Honshu).

Acknowledgments

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